MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

Paper 1 Multiple Choice

October/November 2013

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

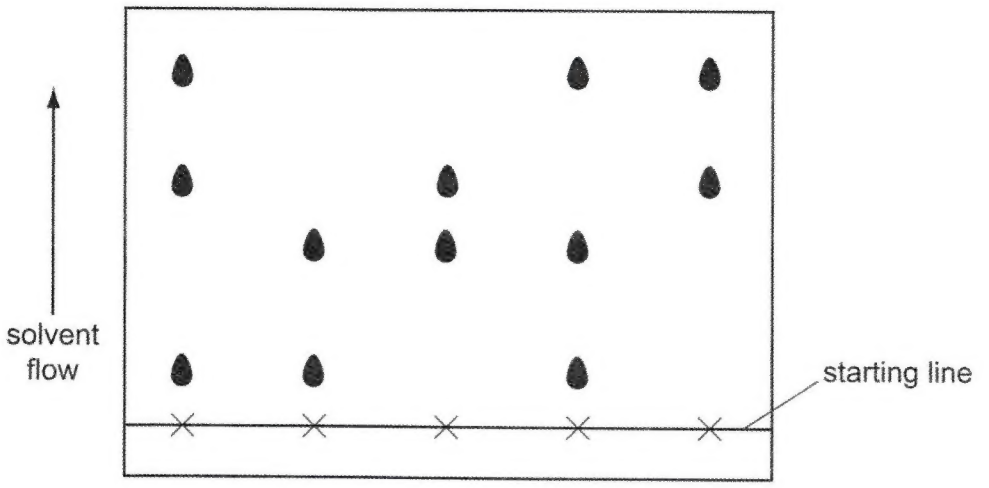
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

21 The diagram shows a chromatogram of five different inks.



How many different dyes were used to make the five inks?

A 3 **B** 4 **C** 5 **D** 12

22 A white crystalline solid, X, is heated with aqueous sodium hydroxide and aluminium.

A piece of red litmus paper, held near the mouth of the test-tube, remains red while the mixture is heated for several minutes.

Which conclusion **must** be correct?

A An acidic gas was given off.

B X is acidic.

C X is magnesium.

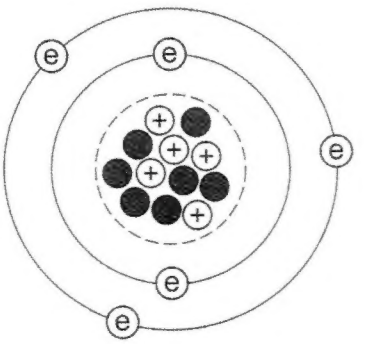
D X is not ammonium chloride.

23 The table gives data about four substances.

In which substance are the particles arranged randomly at room temperature?

	melting point / °C	boiling point / °C
A	–114	–80
B	120	445
C	750	1407
D	1610	2230

24 The diagram shows the structure of an atom.



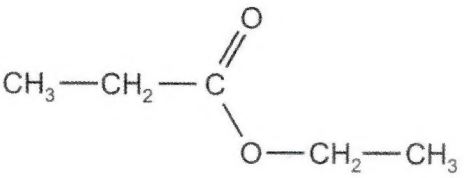
Which atom is represented by the diagram shown?

A $^{11}_{5}B$ **B** $^{12}_{5}C$ **C** $^{12}_{5}B$ **D** $^{12}_{6}C$

25 Which properties represent those of an ionic compound?

	conductivity of solid compound	conductivity of molten compound	conductivity of aqueous solution
A	good	good	good
B	good	good	poor
C	poor	good	good
D	poor	poor	good

26 The diagram shows the molecule ethyl propanoate.



How many bonding pairs of electrons are there in the molecule?

A 7 **B** 13 **C** 16 **D** 17

27 Which is the ionic equation for the reaction between magnesium and hydrochloric acid?

A $Mg + H^+ \rightarrow Mg^+ + H$

B $Mg + H^+ \rightarrow Mg^{2+} + H^-$

C $Mg + 2H^+ \rightarrow Mg^{2+} + 2H$

D $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$

28 An excess of zinc is added to 100 cm^3 of 1.0 mol/dm^3 hydrochloric acid.

The equation for the reaction is

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

What is the maximum volume of hydrogen evolved at room temperature and pressure?

A 1.2 dm^3 **B** 2.0 dm^3 **C** 2.4 dm^3 **D** 24 dm^3

29 Which of the following is an endothermic process?

A adding sodium to water

B dissolving ammonium nitrate in water

C the oxidation of carbon to carbon dioxide

D the reaction between hydrogen and oxygen

30 Which statement about speed of reaction is correct?

A Increasing the concentration of a reactant decreases the speed because there are more collisions.

B Increasing the size of the pieces of a solid increases the speed because there are more collisions.

C Increasing the temperature increases the speed because it increases the number of particles.

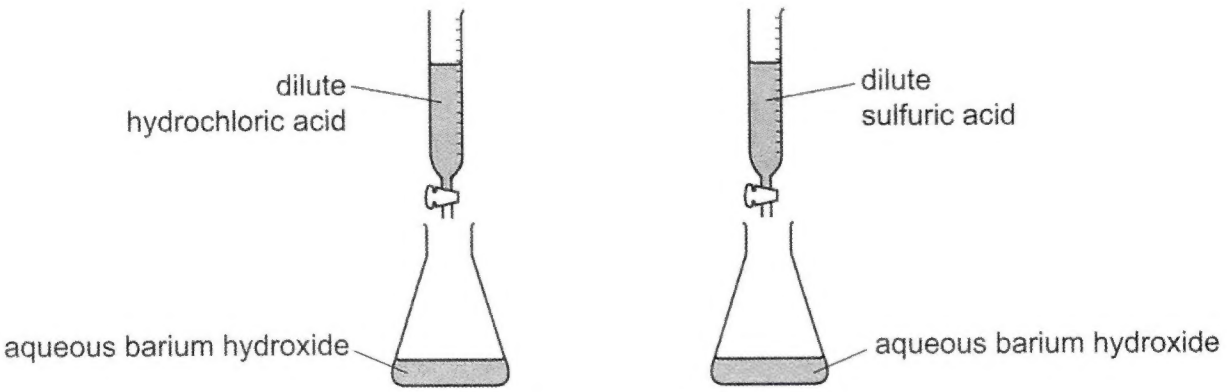
D Increasing the temperature increases the speed because there are more collisions.

31 Which substance in the equation is oxidised?

$$3C + Fe_2O_3 \rightarrow 3CO + 2Fe$$

A C **B** Fe_2O_3 **C** CO **D** Fe

32 The diagrams show two experiments, one to make barium chloride and the other to make barium sulfate.



In each experiment, the acid is run into the conical flask until the pH is 7.

Which are the next steps needed to obtain the solid salts?

	barium chloride	barium sulfate
A	crystallisation	crystallisation
B	crystallisation	filtration
C	filtration	crystallisation
D	filtration	filtration

33 Which statement about the trends in Group VII of the Periodic Table is correct?

On descending Group VII, the elements have

A darker colour.

B decreasing boiling point.

C increasing reactivity.

D lower density.

34 The ionic equations below represent the reactions between the metals copper, iron, zinc and X with solutions of the salts of the same metals.

$$Cu + X^{2+} \rightarrow \text{no reaction}$$

$$Fe + Cu^{2+} \rightarrow Fe^{2+} + Cu$$

$$X + Zn^{2+} \rightarrow X^{2+} + Zn$$

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

$$Zn + Fe^{2+} \rightarrow Zn^{2+} + Fe$$

$$Zn + X^{2+} \rightarrow \text{no reaction}$$

What is the correct order of reactivity of the metals?

	most reactive	⟶		least reactive
A	Cu	Fe	Zn	X
B	X	Fe	Zn	Cu
C	X	Zn	Fe	Cu
D	Zn	X	Cu	Fe

35 Which is **not** a reason for recycling copper?

A copper made by recycling is less pure than that made by extraction

B less energy is needed in recycling than extraction

C to conserve copper ore

D to reduce damage to the environment by mining

36 Carbon monoxide, oxides of nitrogen and sulfur dioxide are all common pollutants of the air.

Which pollutant is shown with its correct source and its adverse effect on the environment?

	pollutant	source	effect on the environment
A	carbon monoxide	combustion of fossil fuels	acid rain
B	carbon monoxide	lightning	global warming
C	oxides of nitrogen	lightning	acid rain
D	sulfur dioxide	volcanoes	global warming

37 The formulae of three compounds are shown.

C_2H_6 C_4H_{10} C_6H_{14}

Which statement about these compounds is correct?

A Their chemical properties are similar.

B Their physical properties are the same.

C They are members of different homologous series.

D They have different general formulae.

38 Which substance is polyunsaturated?

A butter

B ethene

C poly(ethene)

D vegetable oil

39 Which change **cannot** be achieved by a single chemical reaction?

A ethanol to ethanoic acid

B ethanol to propanol

C ethene to ethanol

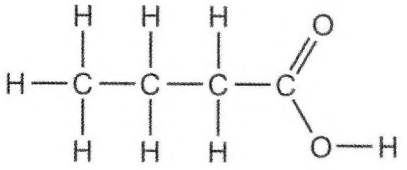
D glucose to ethanol and carbon dioxide

40 The results of two tests on compound Z are shown.

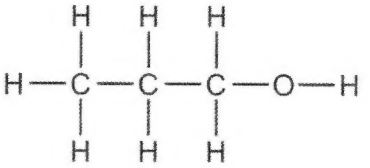
test	result
add bromine water	turns colourless
add aqueous sodium carbonate	carbon dioxide formed

Which structure is Z?

A



B



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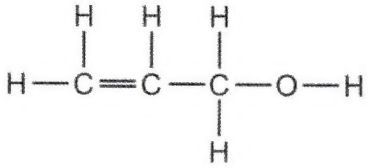
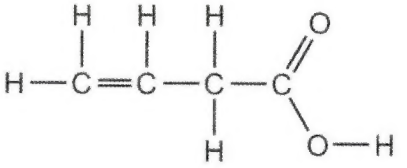


D



(d) G: copper

H: sodium

10. (a) Relative atomic mass refers to the average mass of an atom compared with $\frac{1}{12}$ of the mass of a carbon-12 atom.

(b) (i) Isotopes

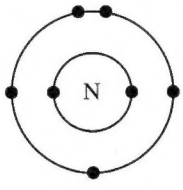
(ii) Nitrogen atoms can exist as isotopes, which have the same proton number but different nucleon number.

However, all nitrogen atoms have 5 valence electrons, regardless of nucleon number, and will have the same chemical properties.

EXAM TIP:

The chemical properties are governed by the number of valence electrons in an element.

(c)



EXAM TIP:

A nitrogen atom has 7 electrons.

(d) (i) Number of moles of $N_2 = \frac{56}{28}$

$= 2$ mol

Since 1 mole of N_2 reacts to form 2 moles of NH_3,

number of moles of NH_3 produced $= 2 \times 2$

$= 4$ mol

Mass of ammonia formed

$= 4 \times (14 + 1 + 1 + 1)$

$= 68$ g

EXAM TIP:

Number of moles $= \frac{\text{Mass}}{\text{Molar mass}}$;

Mass = Number of moles × Molar mass

(ii) Volume of ammonia $= 4 \times 24$

$= 96$ dm^3

EXAM TIP:

Volume (dm^3) = number of moles × molar volume

October/November 2013 Paper 1

Multiple Choice Questions

21. (B)

Comparing the distances that each spot travelled, we find that the spots travel 4 different distances. This means that there are 4 different dyes in the five inks.

EXAM TIP:

In the same chromatogram,

- different dyes travel different distances;
- identical dyes travel the same distance.

22. (D)

X is not ammonium chloride as it does not produce ammonia when heated with sodium hydroxide, indicating that ammonium ions are not present. X is not magnesium since it is not a silvery solid. It is not certain if X is acidic as it is not known if X reacted with sodium hydroxide. While the red litmus paper does not change colour, it can only be certain that no basic gas was evolved. The lack of colour change of red litmus paper could be due to other factors.

EXAM TIP:

We add aqueous sodium hydroxide to the test result, and warm the mixture, to identify the aqueous cation; we add aluminium to the test result to identify the anion; and observe the colour change of the litmus paper to identify the nature of the gas.

23. (A)

Particles in liquids and gases are arranged randomly. Substances B, C and D are in solid state at room temperature. Since substance A boils at –80 °C, it exists as a gas at room temperature.

EXAM TIP:

Find which substance boils at temperatures lower than room temperature. Room temperature can be taken to be 25 °C.

24. (C)

The atom has 5 protons and 7 neutrons. Hence it has a nucleon number of 12 and a proton number of 5. Atoms of different elements each have a specific number of protons. Based on the Periodic Table, the atom is $^{12}_{5}$B. Carbon has 6 protons.

EXAM TIP:

Determine the atom by counting the number of electrons, neutrons and protons.

25. (C)

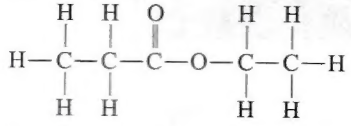
Ionic compounds conduct electricity in molten and aqueous states but not in solid state.

EXAM TIP:

In molten and aqueous states, ions in the ionic compound are free to move, thus can conduct electricity. However, in solid state, there are no mobile ions, thus the ionic compound cannot conduct electricity.

26. (D)

Each covalent bond is formed from a pair of electrons.



Based on the structural formula, there are 10 C–H bonds, 3 C–C bonds, 2 C–O bonds and 1 C=O bond. 1 C=O bond is formed from 2 pairs of electrons. Therefore, there is a total of 17 bonding pairs of electrons.

EXAM TIP:

Each single bond consists of one bonding pair of electrons. Each double bond consists of two bonding pairs of electrons.

27. (D)

Overall equation:

$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

Cancelling out the spectator ions:

$Mg(s) + 2H^+(aq) + \cancel{2Cl^-(aq)} \rightarrow$

$Mg^{2+}(aq) + \cancel{2Cl^-(aq)} + H_2(g)$

Ionic equation: $Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$

EXAM TIP:

Magnesium reacts with hydrochloric acid to produce an aqueous salt and hydrogen gas. Take note of the charge of each element.

28. (A)

Since there is an excess of zinc, hydrochloric acid is the limiting reagent.

$$\text{Number of moles of } HCl = \frac{100}{1000} \times 1.0$$

$$= 0.1 \text{ mol}$$

2 moles of hydrochloric acid produce 1 mole of hydrogen gas.

Maximum number of moles of H_2 evolved

$$= \frac{0.1}{2} \times 1$$

$= 0.05$ mol

Maximum volume of H_2 evolved

$= 0.05 \times 24$

$= 1.2 \text{ dm}^3$

EXAM TIP:

Identify the limiting reagent in the reaction and carry out the calculations based on the amount of limiting reagent present.

29. (B)

Dissolving ammonium nitrate in water is endothermic as heat is absorbed. This can be detected by a drop in temperature.

EXAM TIP:

A reaction that results in a decrease in temperature is endothermic.

30. (D)

An increase in temperature causes an increase in the kinetic energy of reactant particles. As a result, more collisions occur. This leads to an increase in the frequency of effective collisions, allowing for product formation to occur at a greater speed.

EXAM TIP:

The speed of reaction increases when the concentration of a reactant increases; the size of the pieces of a solid decreases or the temperature increases, because these changes result in an increase in the number of effective collisions.

31. (A)

Carbon is oxidised as its oxidation number increases from 0 to +2 when C reacts to form CO. Iron is reduced as its oxidation number decreases from +3 to 0 when Fe_2O_3 reacts to form Fe.

EXAM TIP:

Identify the elements involved in the reaction and determine which element has an increase in oxidation state after the reaction.

32. (B)

Barium chloride is a soluble salt and can only be obtained in solid form through crystallisation. Barium sulfate is insoluble and is found in its solid form, suspended in water. Filtration is required to remove the solid salt from water.

33. (A)

Down Group VII, the colour of the elements gets darker. Chlorine, which is found high in the group, is a yellow-green gas. Iodine, which is found low in the group, is a black solid. The density increases down the group due to the difference in states in which the elements are found at room temperature. Chlorine gas is the least dense. Iodine has the highest density since it is a solid.

EXAM TIP:

Down Group VII, the elements have darker colour, increasing boiling point, decreasing reactivity and higher density.

34. (C)

When a more reactive metal is placed in a solution containing ions of a less reactive metal, the less reactive metal is displaced and deposited. There is no reaction when a less reactive metal is placed in the solution containing ions of a more reactive metal. Based on this, the order of reactivity is X > Zn > Fe > Cu.

EXAM TIP:

A more reactive metal displaces a less reactive metal from its salt solution.

35. (A)

Recycled copper contains a higher percentage of copper than copper ore. Copper obtained from recycling will therefore be purer than copper extracted from its ore.

36. (C)

Lightning causes the formation of oxides of nitrogen. These oxides are acidic and mix in rain water to give acid rain. Carbon monoxide is produced from the incomplete combustion of fossil fuels and causes suffocation when inhaled in excessive amounts. Sulfur dioxide is produced from volcanoes and causes acid rain.

37. (A)

All compounds are alkanes and share the general formula, C_nH_{2n+2}. Members of a homologous series share the same chemical properties but have different physical properties. The physical properties gradually change as the number of carbon atoms (n) changes.

EXAM TIP:

The general formula of each compound can be found based on its chemical formula.

38. (D)

Vegetable oil is polyunsaturated, which means that it has many C=C bonds which can undergo addition reaction to form margarine. Ethene is unsaturated but only has one C=C bond.

EXAM TIP:

A polyunsaturated substance contains multiple C=C bonds.

39. (B)

Ethanol cannot be converted to propanol directly and will require multiple steps to obtain propanol. Ethanol undergoes oxidation reaction to form ethanoic acid. Ethene undergoes hydration with water to form ethanol. Glucose is fermented to form ethanol and carbon dioxide.

EXAM TIP:

Propanol cannot be obtained by a single chemical reaction with ethanol.

40. (D)

The decolourisation of bromine water indicates the presence of C=C bonds. The reaction of sodium carbonate indicates the presence of –COOH group. Therefore compound Z is (D).

EXAM TIP:

Bromine water is used to test for unsaturated compounds and aqueous sodium carbonate is used to test for H^+ ions.

October/November 2013 Paper 3

Section A

1. **(a)** Nitrogen

Oxygen

EXAM TIP:

Clean air consists of approximately 78% nitrogen, 21% oxygen, 0.97% noble gases (mainly argon) and 0.03% carbon dioxide.

(b) changes to spacing: The spacing between particles decreases.

changes to movement: Particles move slower in liquid state than in gaseous state.

EXAM TIP:

Gaseous particles are spaced far apart from each other and move freely at high speeds, while liquid particles are packed closely together and slide past each other.

2. **(a)**

substance	**chemical formula**	**solubility in water**	**acidic or alkaline or neutral**	**colour of solution with Universal Indicator**
calcium chloride	$CaCl_2$	soluble	neutral	**green**
sulfuric acid	**H_2SO_4**	soluble	acidic	**red**
potassium carbonate	K_2CO_3	soluble	alkaline	**violet**
lead(II) carbonate	$PbCO_3$	insoluble		
calcium carbonate	**$CaCO_3$**	insoluble		

(b) **(i)** 1. Calcium chloride

2. Potassium carbonate

EXAM TIP:

Two soluble reactants are required for a precipitation reaction.

(ii) 1. Filter the precipitate

2. Wash with distilled water

3. Dry with filter paper

EXAM TIP:

The method of purification must be suitable for obtaining insoluble salt.